

PROJECT 8040
1981 ENERGY USE ENGINEERING UPDATE
ON THE MONITORING
OF SOLAR SYSTEMS IN B. C.

SYNOPSIS:

This report outlines the system performances of all the solar test homes being monitored by B. C. Hydro in 1981.

With a commitment to monitor up to 200 solar applications, only 62 test homes were on file at the end of 1981. This is an ongoing monitoring program of which the Energy Use Engineering Department plans to continue for the next three to five years.

A summary report will be written on the performances of all our solar homes every 12 months, or as often as meaningful.

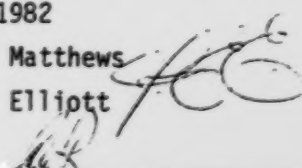
PROJECT:

Initiated/Requested by: J. E. Elliott

Date Completed: June 1982

Completed by: G. W. Matthews

Supervised by: J. E. Elliott

Approved by: 
R. W. Racine, P.Eng., Manager
Energy Use Engineering

Initial Distribution	Energy Use Committee	J. Olson
	EUE Supervisors	R. W. Racine
	T. J. Newton	R. Schneider



ENERGY USE ENGINEERING DEPARTMENT
PROJECT SUMMARY

PROJECT No. 8040

PRIORITY 2

TITLE: MONITORING OF SOLAR APPLICATIONS IN B.C.
1981 ENERGY USE ENGINEERING UPDATE ON THE
MONITORING OF SOLAR SYSTEMS IN B.C.

INITIATED/REQUESTED BY: J.E. Elliott

ASSIGNED TO: G.W. Matthews ASSIGNED BY: J.E. Elliott

DATE ASSIGNED: June 1981 DATE REQUIRED:

ESTIMATED COMPLETION: June 1982 COMPLETED: June 1982

OBJECTIVES AND NOTES:

B.C. Hydro has made a commitment to monitor up to 200 solar applications in B.C. to provide us with solar availability figures and equipment performance as well as give some idea on energy savings.

Provide a report, on an annual basis showing results of the monitoring program, giving the number of systems added over previous year.

The systems and savings should show totals, then breakdown into regional totals as we accumulate a larger number of systems. Also, the systems at R&D and Lochburn should be included.

Feedback should be provided annually to customers with a copy to applicable Regional/District Offices.

COPIES TO: DEPARTMENT MANAGER (THEN RECORD FILE), BLUE FILE, SUPERVISOR, (J.E. Elliott)
A.A. Gibson H.F. Robertson R.M. Schneider
V.M. Hannula D.A. Ross
E.H. Williams J.H. Mitchell

PLEASE ADVISE AS SOON AS POSSIBLE IF CHANGES ARE REQUIRED ABOVE

ENERGY USE ENGINEERING DEPARTMENT
ENERGY CONSERVATION DIVISION

B.C. HYDRO



EXECUTIVE SUMMARY

The Interim Report 8040 (Monitoring of Solar Systems in B. C.) discusses the solar contributions for all the test homes that were in B. C. Hydro's Solar Monitoring Program from the beginning of the test program in 1978 to 1980. This project report summarizes the performance of all solar homes from 1980 to the end of 1981.

With 62 solar test homes on file at the end of 1981, our overall findings to date show that, in the B. C. environment, solar may contribute the following average annual percentages:

16% to 89% for domestic water heating

13% to 96% for swimming pool heating

0% to 78% for space heating

Total kW.h's saved due to solar in our monitoring program during 1981 amounted to 381,380 kW.h, giving a total of 539,300 kW.h for 1980 and 1981.

It is estimated that we will add 30 to 40 additional solar systems to this program in the fiscal year.

Information metering will be removed on the test homes where Energy Use Engineering is not receiving sufficient energy utilization data.

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1.0 INTRODUCTION

The Energy Use Engineering Department of B. C. Hydro has undertaken a program aimed at monitoring up to 200 solar applications. The objective of the program is to do solar feasibility studies in the B. C. environment. This solar monitoring program started early in 1978 and has on file at the end of 1981 some 62 solar test homes. The Interim Report #8040 discusses the performance characteristics of the 26 solar test homes from the start of our monitoring program until 1980. This project report is a continuation and will summarize the performance of all 62 solar test homes from 1980 up until December of 1981.

Now that there is a considerable amount of monthly data that is being received by EUE, the Residential Applications Section has gone ahead and computerized the program. This monthly data is still coming in by telephone and/or information meter dial cards.* Upon receiving it, the data is now entered into our in-house mini-computer (MINC 11), where the data is stored, and any calculations and bookkeeping is done. This computerization process has cut down quite dramatically on the EUE man-hours spent on data handling and processing. For further information in regards to the computerization of our Solar Monitoring Program, see Project Report #8131.

2.0 SOLAR ASSISTED SYSTEMS

2.1 Number and Types of Applications

As of December 1981, the Energy Use Engineering Department, with the assistance of the regions and districts involved is monitoring 62 applications which are utilizing solar energy.

Of the applications, 32 are domestic water heating systems, 18 are swimming pool systems, while the remaining 12 are space heating systems. See Table 1 for a regional breakdown of the number and types of solar applications.

* Reference Project Report 7924

Of the 62 systems currently being monitored, only 50 participants are providing data for the Energy Use Engineering Department on a regular monthly basis.

2.2 Location of Applications

The monitoring boundaries are within the province of British Columbia but principally within the six Hydro Regions. Table 1 lists the application types and areas in which they are located.

Areas Being Monitored		Number of Applications			
		Solar Space Heating	Solar Domestic Water Heating	Solar Pool Heating	Total
Lower Mainland	Metro	5	16	13	34
	Fraser Valley (FV)	1	7	5	13
Vancouver Island (VI)		0	5	0	5
Southern Interior (SI)		4	3	0	7
Central Interior (CI)		2	1	0	3
North Coast (NC)		0	0	0	0
TOTAL		12	32	18	62

Table 1: Number, Types and Location of B. C. Hydro's Solar Monitoring Installations

2.3 Solar Space Heating Systems

As of December 1981, the Energy Use Engineering Department was monitoring 12 solar space heating systems in B. C.

The 12 space heating applications studied were broken down in the following categories:

- two test sites incorporated solar collectors and storage tanks for their space heating systems (active);
- four systems relied solely on the structural mass of the building itself for the collection, storage and distribution of the solar energy (passive);
- three homes combined both active and passive space heating systems (hybrid);
- three homes used attached greenhouse designs.

System details of all solar space heating systems on file are outlined in Table 2 found in Appendix A.

Two of the above systems are providing solar assistance for the space heating requirements for an alternate energy display office and an elementary school. The remaining ten systems are installed on single family dwellings.

Our results show that attached greenhouse solarium design provides the best results, followed by passive and trombe wall construction. Most of our passively heated homes utilize wood burning stoves, and thus it was difficult to get an accurate indication of the total number of Btu's of energy going into the house for the space heating requirements.

Given below is an overall summary of the solar space heating installations being monitored as of December 1981.

	<u>Space Heating</u>		
	<u>Total #</u>	<u># Added In 1981</u>	<u>1980-81 Solar Contribution</u>
Lower Mainland	6	4	Range 0 - 78%
Southern Interior	4	0	Range 38 - 73%
Central Interior	2	1	Range 60 - 67%

The provincial annual average solar contribution ranged from 0% to 78%, with an overall average of 42%.

The names, location and average monthly solar contribution of each solar assisted space heating system is given in Appendix A.

Several low energy homes are also being monitored by EUE, but will be dealt with under a separate report, because the scope of this report deals specifically with solar assisted heating installations.

2.4 Solar Domestic Water Heating Systems

Of the 32 solar domestic water heating systems studied, only 27 participants are providing data for the Energy Use Engineering Department on a regular monthly basis.

A majority of the water heating installations fall under the following four categories:

1. Drain Down System
2. Drain Back System
3. Closed Loop System
4. Thermosiphon System

Flow diagrams of the above typical four systems are provided in the Interim Report 8040.

System details of all solar domestic water heating systems on file are outlined in Table 3 found in Appendix B.

Given below is an overall summary of the solar domestic water heating installations being monitored as of December 1981.

Domestic Water Heating

	<u>Total #</u>	<u># Added In 1981</u>	<u>1980-81 Solar Contribution</u>
Lower Mainland	23	7	Range 16 - 63%
Vancouver Island	5	4	Range 18 - 52%
Southern Interior	3	2	Range 89%
Central Interior	1	1	Range 53%

The average monthly solar contribution ranged from 0% on some systems during the months of December and January, up to 94% during the peak summer months.

The provincial annual average solar contribution ranged from 16% to 89%, with an overall average of 43%.

The names, location and average monthly solar contribution of each solar water heating system is given in Appendix B.

2.5 Solar Pool Heating Systems

As of December 1981, EUE was monitoring 18 solar pool heating systems, of which only 13 pools were providing energy utilization data on a regular basis. All pools monitored are using active solar systems and are generally operated between May and September. Not all the pools monitored were outdoor installations. System details of all solar pool heating systems on file are outlined in Table 4 found in Appendix C.

The theoretically predicted energy consumption for the pool heating season was taken from our POLMOD Computer Program, Reference Project Report #8128.

The % solar contribution figures given to each pool owner are estimates only. The swimming habits of pool owners make it very difficult to get an accurate figure. It was noticed that most applicants turned off the pool heaters when the pool was

not being used and normally turned them on again a day or two prior to use.

Given below is an overall summary (both indoor and outdoor pools) of the solar pool heating installations being monitored as of December 1981.

Swimming Pool Heating

	<u>Total #</u>	<u># Added In 1981</u>	<u>1980-81 Solar Contribution</u>
Lower Mainland	18	6	Range 13 - 96% (53% Average)

The average seasonal solar contribution for outdoor swimming pools (usually from May to September) ranged from 13% to 96%, with a total average of 51%.

Indoor swimming pools, usually operating eight to ten months out of the year (February to November), showed an average seasonal solar contribution which ranged from 45% to 92%, with a total average of 65%.

The names, location and average monthly solar contribution of each solar pool heating system is given in Appendix C.

2.6 B. C. Hydro Research and Development Facilities

2.6.1 Solar Thermal System

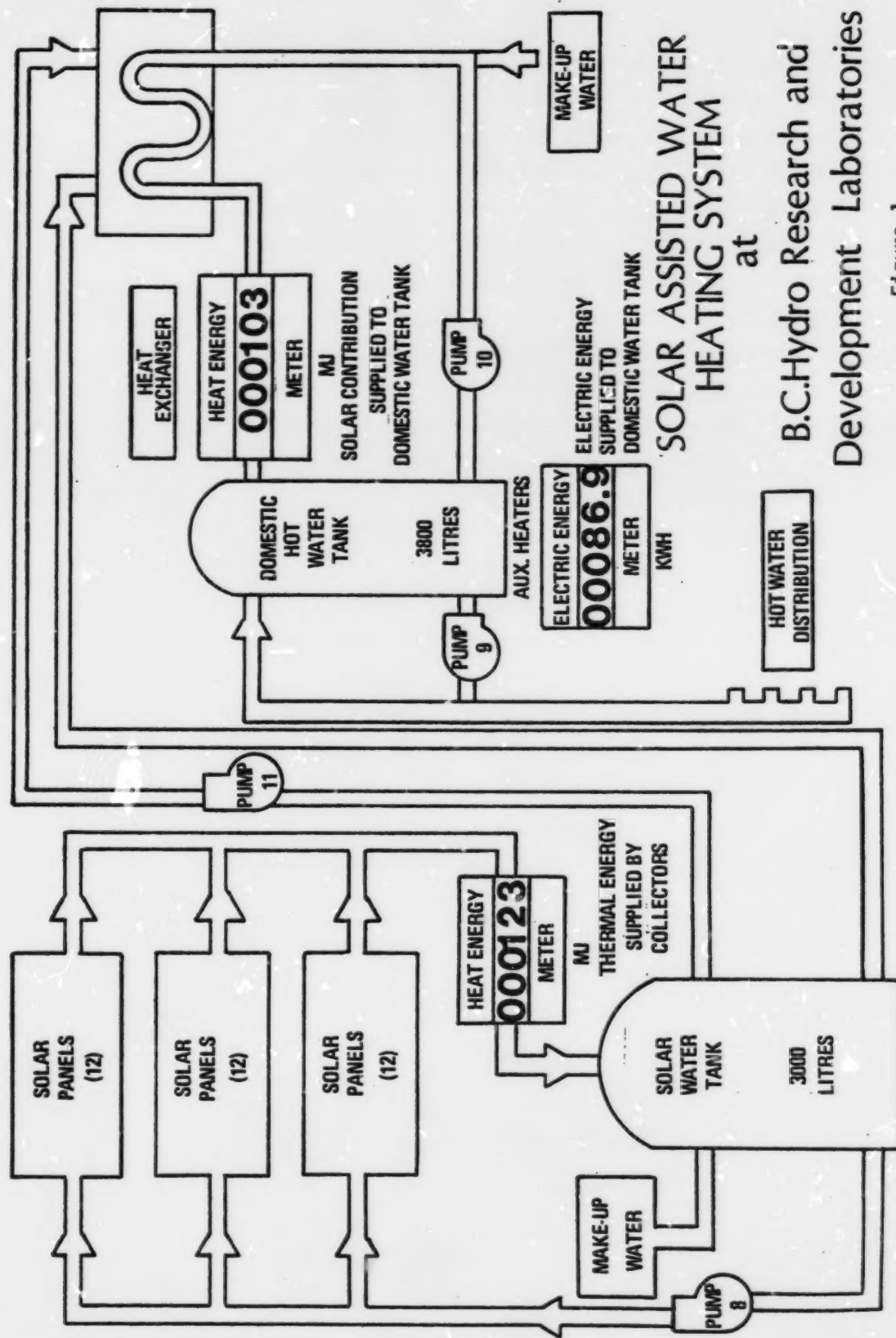
The Research and Development Facilities incorporates a solar array which can provide a large portion of the hot water required for the building. The collector area is 600 square feet and consists of 12 panels each from Lennox, Miromit and Solar Systems. Heat from these panels is stored in a 660 gallon tank which is coupled to an 840 gallon hot water tank through a heat exchanger.

Ordinary city water, with a small amount of chemical inhibitor, is used in the primary circulation loop; antifreeze is not required because the system drains back to the 660 gallon tank under low sun conditions. The system is automatic in operation; a separate absorber plate actuates the primary circulation system, heat is extracted from the 660 gallon tank when called for by a differential thermostat and requirements for hot water exceeding the delivery from the collector are made up for by two electrical heaters in the hot water tank.

The performance of the system is measured automatically using a datalogger and a digital tape recorder. Since the collectors are on the roof of the building and the storage tanks, pumps and heat exchanger are in the basement, remote scanners are used to transmit the sensor outputs to the datalogger in the laboratory. The sensors include 20 platinum resistance thermometers, eight flow-meters, three pyranometers, one wind velocity/direction meter and two kilowatt hour meters. Auxiliary equipment includes an integrator (for solar power input), bright sunshine meter and several joulemeters (thermal transfer measurements).

Figure 1 shows the flow diagram of the solar thermal system at the R&D facilities.

Research on the system will include optimizing the collector efficiencies, comparison of the collectors, relationships between demand for hot water and solar energy available and verification of theoretical models for hot water and space heating systems.



SOLAR ASSISTED WATER HEATING SYSTEM

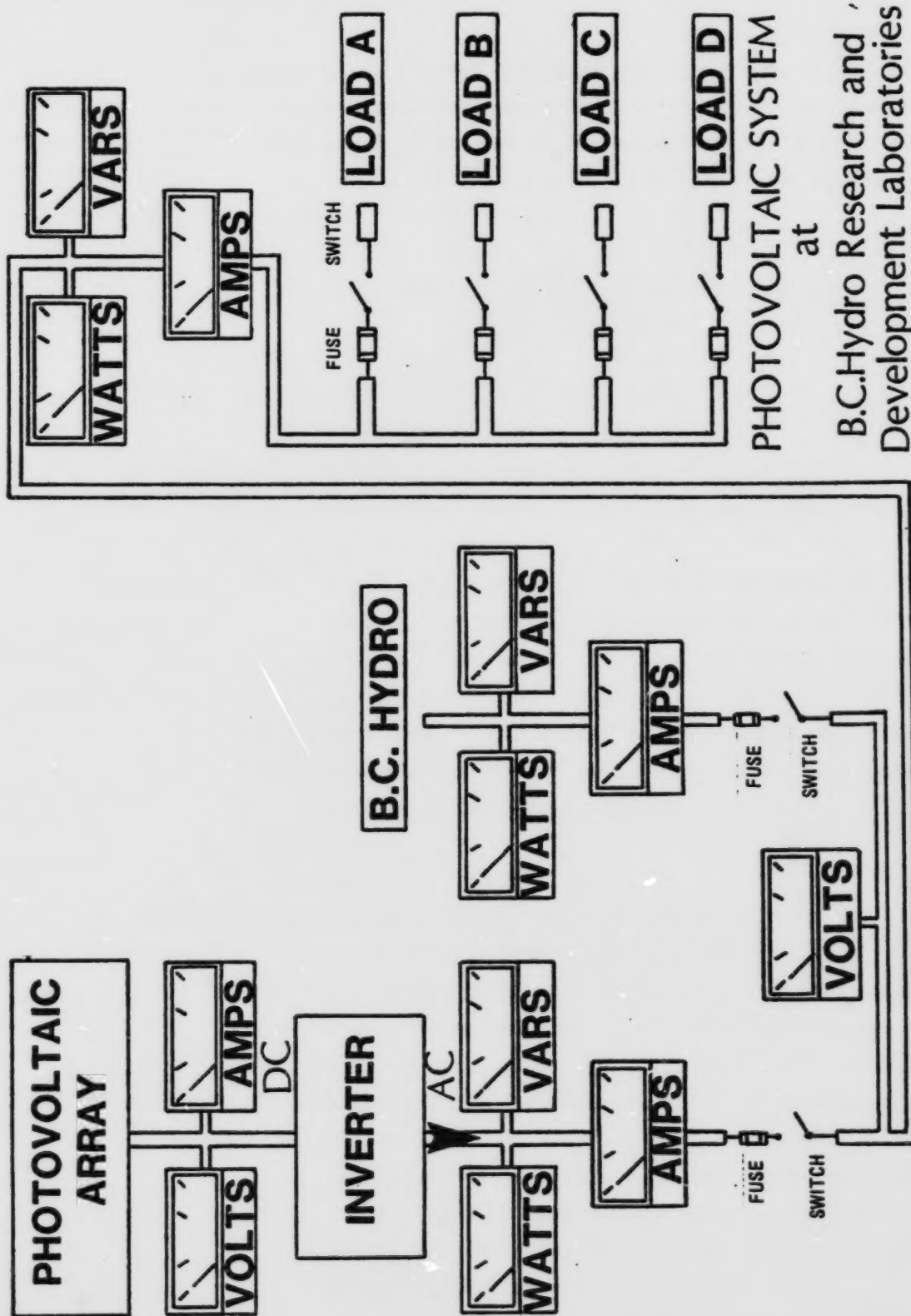
at
B.C.Hydro Research and
Development Laboratories

Figure 1

2.6.2 Photovoltaic System

The photovoltaic system consists of 32 panels with a combined output of 1 kW under full sunlight. Each panel contains 35 silicon photodiodes and produces about 2 amps at 16 volts DC. The panels are wired so that a range of voltages, from 16 volts to about 250 volts DC can be supplied to the laboratory. The DC power is then inverted by solid state electronics to 120 volts AC so that AC loads can be operated directly. The static inverter performs in such a way as to operate the panels under maximum output for prevailing sunlight. This means that the electronics must adjust the system to provide power to intermittent loads, supplement the solar power with 120 volts AC from the Hydro system when required and feed excess power into the Hydro system if it is available. The R&D system will be used to study the performance of photovoltaic converters under actual use conditions.

Figure 2 shows the system diagram of the photovoltaic system at the R&D facilities.



PHOTOVOLTAIC SYSTEM

at

B.C. Hydro Research and
Development Laboratories

Figure 2

2.6.3 General Comments

Both solar thermal and photovoltaic systems at the Hydro Research and Development Facilities have been installed and have been operating for a little over a year now. Most of the initial startup problems have now been resolved.

Typical problems that have been encountered were:

1. Thermal System

(a) Collectors

- * - excessive condensation buildup under the glazings of the collectors
- the Miromit Collectors had glazing problems (the glazings on most of the collectors popped loose allowing rain water to accumulate on the inside of the collector housings)
- * - some pipe fittings used in the connections between collectors were not recommended to be used outside because of corrosion problems.

(b) Pumps and Tanks

- sun shining with no pumps running
- all pumps running during overcast and rainy days
- all pumps running during the evenings and over night
- a 15 pounds per square inch (psi) dump solenoid valve installed (dumps hot water automatically when little or no hot water is used during the weekends. This prevents overheating of the water in the solar storage tank). The 60 psi city mains pressure prevented the dump solenoid valve from working properly, (150 psi valve later installed).

(c) Instrumentation

- excessive condensation buildup inside the pyranometers
- * - possible shading of the pyranometers because of the way they are mounted
- * - wind vane not installed
- * - Campbell Stokes recorder is not logging bright sunshine hours (no chart paper installed)
- failure of the output driving circuitry in the pyranometer integrator resulted when it was overloaded by connecting too many additional display and recording apparatus. (Internal electronic components had to be replaced with more suitable ones.)
- * - Btu meters used despite the decreased accuracy when the temperature differential between the two sensors is $<5^{\circ}\text{F}$
- * - water flow sensor in the city cold water makeup line has an intermittent fault. This transducer provides the electronic signal for the datalogger. This signal corresponds to actual hot water consumed at the R&D facility
- * - Btu flowmeters on both sides of the tube and shell heat exchanger have been out of commission for over 12 months and have been sent away for servicing as a result of a sludge problem which occurred in the concrete lined storage tanks.

2. Photovoltaic System

(a) Collectors

- one of the collector panels was slightly damaged during the installation phase.

(b) Instrumentation

- some faulty current transformers (CT's) were installed to monitor the electrical energy in the system
- faulty VAR transducers were installed on the instrument display panel.

(c) Operation

- * - excessive amount of VAR's are consumed in the synchronous inverter under light or no load conditions (Reference: Protection and Control Department Test Report on Gemini Model 20A-1120-3 Synchronous Converter).

3.0 DATA HANDLING

Most of the monthly energy utilization data is still read and recorded by the test home participants. This form of meter reading has been continued because of the inaccessibility of the information metering by our own staff (i.e., Hydro meter readers). Some of the information energy data is read and recorded by our Hydro meter readers but usually in the case where the information meters have been mounted outside, as in our outdoor pool monitoring applications.

This data is sent to EUE by the test home participants by way of phone or by information meter dial cards,** which are mailed in.

The EUE Department has been monitoring residential, commercial and industrial energy applications for many years now. It was noticed that most of the EUE man-hours spent on these programs were in dealing with the handling of this energy utilization data. Data

* Existing problems

** Reference Project Report 7924

would be collected by chart recorders and/or manual readings taken and then transferred to tables where they would be easily accessible for future use. This raw data would then be plotted, calculations done and conclusions drawn. This process is time consuming and should be automated wherever possible.

When the monthly data is received, it is now entered into our MINC PDP11 inhouse computer.* Here the data is stored, edited and calculations done to give us our final output requirements (% solar contribution and energy savings).

The computerization of the monthly energy utilization data has cut down quite dramatically on EUE man-hours spent on data crunching. The EUE man-hours normally spent on recording data and performing the energy calculations required in order to draw our conclusions, were in the neighborhood of approximately 14 to 18 hours per month for the 62 solar test installations we now have on file. Now with the computerization of this data, the EUE man-hours spent are approximately four to eight hours per month.

These relatively easy job functions can now be carried out by our steno/clerk allowing valuable EUE engineering time to be spent on the development of energy conservation programs.

The algorithms used to calculate the percent solar contribution figures shown in Appendices A, B and C, are similar to the ones used in the previous solar summary report. For further clarification and an in-depth look at these calculating procedures, see Interim Project Report 8040.

4.0 PROGRAM EVALUATION AND FUTURE RECOMMENDATIONS

Presently, the monthly energy utilization data is still read and recorded by the solar test home participants. It is forwarded to EUE by telephone or by the information meter dial cards, which are

* Reference Project Report 8131

mailed in. This method of data retrieval works out reasonably well, but still there appears to be some inconsistency. Some of the data was not obtained because of the test home residents forgetting to take the meter readings. Usually, we can work around this inconsistency problem and take bimonthly, quarterly and even annual averages. One way around this inconsistency problem is to look into the possibility of remote meter reading. The only drawback with this is that the hardware costs of such a proposal would be quite high. Where information metering is installed and the EUE is receiving insufficient energy utilization data to draw any concrete conclusions from, the metering will be removed.

Now that the monthly data is entered directly into our in house computer (MINC PDP11), up to 40-70% of EUE man-hours are saved by letting the computer store and do the required calculations.

Also by using the computer, the water tank heater efficiencies are calculated every month and used in the algorithms for calculating the % solar contribution for the domestic water heating systems. Before the computerization process, annual average efficiency figures were used.

Now that we have a significantly larger number of test homes, we can more accurately determine the performance characteristics of different solar systems. This is particularly useful when looking at different solar space heating systems (i.e. Trombe wall vs attached greenhouse design, etc.). With the addition of another 130 solar homes over the course of the monitoring program, better conclusions can be drawn.

Hydro's R&D Facilities solar systems have both been installed and have been operating for over 12 months. Presently, system variables are being recorded and stored by the datalogger. This data is being logged into final memory every 30 minutes for about 12 to 16 hours per day. Some of the transducers are not working in the

systems, making it very difficult to draw any concrete conclusions from. Sophisticated computer programming has been carried out by Hydro's Computer Sciences Department in an attempt to store the logged data. Weekly manual readings of the energy utilization data have been taken since March 1981. From these readings, it was noted that both the solar thermal and photovoltaic systems require some fine tuning in order to get a significant amount of solar gains.

Detailed analysis will be carried out over the next year.

Summary of Proposed Action

1. Foster and solicit the addition of more test sites, action required by regions, districts and Energy Conservation Division.
2. Continuation of the computerization of the monitoring and analysis, with the possibility of using remote meter reading schemes on some of the test homes, action by the Residential Applications Section in cooperation with the EUE Computerization Program.
3. Remove information meters from the test homes where EUE is not receiving sufficient energy utilization data to draw any concrete conclusions. Action by regions, districts and Energy Conservation Division.
4. Arrange for the solar systems problems that are still present at the Hydro R&D facilities to be corrected and to get both solar systems functioning properly, action by Special Projects Group at R&D, Energy Conservation Division and the Hydro Electrical and Mechanical Design Departments involved.

5.0 ACKNOWLEDGEMENTS

Energy Use Engineering is indebted for the cooperation received from:

Jack Clarke	Lochburn
Ken Jarvis	Lochburn
Bill Wilson	Electric Meter Shop
Lyle McClelland	EUE Department
Lori Smith	EUE Department
Tom Christie	Coquitlam
Pat Nash	Richmond
Norm Ford	Vancouver
Cliff Melin	Surrey
Gordon Trofananko	Kamloops
Ken Hodges	Kamloops
Pat White	Vernon
Ian Gibson	Fort St. John
Bill MacMillan	Prince George
Jack Doherty	North Vancouver
Pat Beaven	Sechelt
Leroy Watt	Squamish
Don Rankin	Surrey
G. Sadler	Victoria
John Kennaird	Qualicum

which greatly assisted in the implementation of this monitoring project.

APPENDIX A

SOLAR CONTRIBUTIONS FOR SOLAR
SPACE HEATING APPLICATIONS

APPENDIX A

RECORDED AND PROCESSED DATA

Below are the names and locations of the 12 solar space heating systems being monitored.

Metro

1. Leekha Residence - Coquitlam, B. C.
2. Blackall Residence - Coquitlam, B. C.
3. Stewart Residence - Richmond, B. C.
4. Logan Residence - Vancouver, B. C.
5. SPEC - Vancouver, B. C.

Fraser Valley

6. Kartasheff - Crescent Beach

Southern Interior

7. Pineridge School - Kamloops, B. C.
8. Rink Residence - Kamloops, B. C.
9. Milligan Residence - Vernon, B. C.
10. Knuever Residence - Vernon, B. C.

Central Interior

11. Dixon Residence - Fort St. John, B. C.
12. Hathaway Residence - Prince George, B. C.

SOLAR SPACE HEATING SUMMARY

42% average annual solar contribution with an overall variation of 0% to 78%.

1040 therms energy required (average) for space heating for 80/81.

2900 square feet average heated area.

69°F (20°C) average thermostat setting.

System details of all solar space heating systems on file are outlined in Table 2.

Location		Building Type	Solar System Type	System Installation Date
Region	City			
Metro	Coquitlam	Home	Active	June 1978
	Coquitlam	Home	Passive	January 1981
	Richmond	Home	Greenhouse	April 1980
	Vancouver	Home	Hybrid	April 1981
	Vancouver	Office	Greenhouse	November 1981
Fraser Valley	Crescent Beach	Home	Hybrid	March 1981
Southern Interior	Kamloops	School	Active	September 1980
	Kamloops	Home	Passive	February 1980
	Vernon	Home	Hybrid	August 1980
	Vernon	Home	Passive	June 1980
Central Interior	Fort St. John	Home	Passive	June 1978
	Prince George	Home	Greenhouse	June 1978

Table 2: Solar Space Heating System Details

The average annual solar contributions for the solar space heating systems being monitored are given on the following pages.

LEEKHA RESIDENCE
COQUITLAM, B. C.

1. Solar Space Heating System Details

- active Drainback System
- 700 ft² of Collectors (Slope 50°/Azimuth 22° SE)
- 6000 Imperial Gallon Solar Storage Tank.

2. House Details

(a) Floor Area:

Basement:	1250 ft ²
Main Floor:	1900 ft ²
Attic:	<u>1250 ft²</u>
Total:	4400 ft ²

(b) Insulation

Ceiling:	R 28
Walls:	R 20

(c) Windows:

- double Glazed ($\frac{1}{2}$ " air space thermally broken).

(d) Exterior Doors:

- 2" standard wooden doors (no storm doors).

(e) Average Indoor Temperature

Daytime:	68°F
Nighttime:	68°F.

(f) Backup Heating System:

- natural gas forced air furnace with electrical baseboards in the attic rooms.

3. Solar Performance

- (a) Observation Period: 1 January 1981 - 1 January 1982.
- (b) 54% solar contribution during observation period.
- (c) 1002 therms savings during observation period.

B. C. Hydro Representative

Peter Valkenburg
Coquitlam, B. C.

BLACKALL RESIDENCE
COQUITLAM, B. C.

1. Solar Space Heating System Details

- passive Direct Gain.

2. House Details

(a) Floor Area: 1585 ft²
Total:

(b) Insulation
Ceiling: R 40
Walls: R 30

(c) Windows:
- double glazed ($\frac{1}{2}$ " air space thermally broken).

(d) Exterior Doors:
- 2" standard wooden doors (with storm doors).

(e) Average Indoor Temperature
Daytime: 70°F
Nighttime: 65°F.

(f) Backup Heating System:
- natural gas forced air furnace.

3. Solar Performance

(a) Observation Period: 2 February 1981 - 1 February 1982.

(b) 78% solar contribution during observation period.
*9% wood contribution during observation period.

(c) 547 therms total savings as a result of solar and wood contribution during observation period.

B. C. Hydro Representative

Peter Valkenburg
Coquitlam, B. C.

* Wood stove was used in conjunction with natural gas forced air furnace.
One-half chord of alder used at \$68/chord (30% moisture content).

STEWART RESIDENCE
RICHMOND, B. C.

1. Solar Space Heating System Details

- passive Direct Gain
- Trombe Wall
- solarium

2. House Details

- (a) Floor Area:
- | | |
|------------|----------------------------|
| Top Floor | 900 ft ² |
| Main Floor | <u>1520 ft²</u> |
| Total | 2420 ft ² |
- (b) Insulation
- | | |
|----------|------|
| Ceiling: | R 28 |
| Walls: | R 20 |
- (c) Windows:
- double glazed.
- (d) Exterior Doors:
- 2" standard wooden doors (no storm doors).
- (e) Average Indoor Temperature
- | | |
|------------|------|
| Daytime: | 70°F |
| Nighttime: | 70°F |
- (f) Backup Heating System:
- natural gas hot water hydronic system.

3. Solar Performance

- (a) Observation Period: 5 March 1981 - 4 March 1982.
- (b) 0% solar contribution during observation period.
- (c) No savings during observation period.

B. C. Hydro Representative

Pat Nash
Richmond, B. C.

LOGAN RESIDENCE
VANCOUVER, B. C.

1. Solar Space Heating System Details

- hybrid Trombe wall 400 ft².

2. House Details

(a) Floor Area:

Top Floor:	800 ft ²
Main Floor:	<u>1400 ft²</u>
Total:	2200 ft ²

(b) Insulation

Ceiling:	R 28
Walls:	R 20

(c) Windows:

- triple glazing.

(d) Doors:

- 2" standard wooden door (no storm doors).

(e) Average Indoor Temperature

Daytime:	70°F
Nighttime:	65°F

(f) Backup Heating System:

- natural gas forced air system.

3. Solar Performance

(a) Observation Period: June 1980 - May 1981.

(b) 0% solar contribution during observation period.

(c) No savings during observation period.

B. C. Hydro Representative

Don Hulme
Burnaby, B. C.

SOCIETY PROMOTING ENVIRONMENTAL CONSERVATION (SPEC)
VANCOUVER, B. C.

1. Solar Space Heating System Details

- attached greenhouse
- water drum storage.

2. Office Details

(a) Floor Area:

Main Floor:	2000 ft ²
Basement:	<u>1800 ft²</u>
Total:	3800 ft ²

(b) Insulation

Ceiling:
Walls:

(c) Windows:

- double glazed

(d) Doors:

- 2" insulated doors (air lock vestibule).

(e) Average Indoor Temperature

Daytime:	70°F
Nighttime:	65°F

(f) Backup Heating System:

- natural gas forced air system.

3. Comments

- new solar space heating account
- no energy utilization data for 1981.

B. C. Hydro Representative

Don Hulme
Burnaby, B. C.

KARTASHEFF RESIDENCE
SURREY, B. C.

1. Solar Space Heating System Details

- Trombe wall
- active air collectors
- rock bin storage.

2. House Details

- (a) Floor Area:
- | | |
|-------------|---------------------------|
| Main Floor: | 2375 ft ² |
| Basement: | <u>970 ft²</u> |
| Total: | 3345 ft ² |
- (b) Insulation
- | | |
|----------|------|
| Ceiling: | R 30 |
| Walls: | R 20 |
- (c) Windows:
- double glazed.
- (d) Doors:
- 2" standard wooden doors.
- (e) Average Indoor Temperature
- | | |
|------------|------|
| Daytime: | 70°F |
| Nighttime: | 65°F |
- (f) Backup Heating System:
- natural gas forced air system.

3. Solar Performance

- (a) Observation Period: December 1980 - December 1981.
- (b) 13% solar contribution during observation period.
- (c) 177 therms savings during observation period.

B. C. Hydro Representative

Cliff Melin
Surrey, B. C.

PINERIDGE ELEMENTARY SCHOOL
KAMLOOPS, B. C.

1. Solar Space Heating System Details

- active drainback system
- 1960 ft² of collectors (slope 60°/Azimuth 0° due south)
- 15,000 Imperial gallon solar storage tank.

2. School Details

- (a) Floor Area: 12,925 ft² (Stage 1).
- (b) Insulation
 - Ceiling: R 37
 - Walls: R 24
- (c) Windows:
 - double glazed.
- (d) Doors:
 - 2" insulated doors.
- (e) Average Indoor Temperature
 - Daytime: 70°F
 - Nighttime: 65°F
- (f) Backup Heating System:
 - electric heat pumps and natural gas boiler.

3. Comments

- because of the insufficient energy utilization data that was collected from the school before it had any solar system installed, it was difficult to get an indication of an estimated annual energy consumption (EAEC) figure;
- even if the EAEC figure were available, the percent solar contribution for the space heating load would ~~still~~ be very difficult to calculate because of the lack of the performance figures for the heat pumps (i.e. seasonal performance factor and coefficient of performance).
- provisions will be made to have the information metering removed.

B. C. Hydro Representative

Ken Hodges/Gordon Trofananko
Kamloops, B. C.

RINK RESIDENCE
KAMLOOPS, B. C.

1. Solar Space Heating System Details

- attached greenhouse
- water drum storage.

2. House Details

- (a) Floor Area: total 1900 ft².
- (b) Insulation
 - Ceiling: R 50
 - Walls: R 40 (envelope construction, double stud walls).
- (c) Windows:
 - double glazing south facing wall
 - triple glazing north, east and west walls.
- (d) Doors:
 - 2" standard wooden doors.
- (e) Average Indoor Temperature
 - Daytime: 70°F
 - Nighttime: 70°F
- (f) Backup Heating System:
 - electric baseboards.

3. Solar Performance

- (a) Observation Period: December 1980 - December 1981.
- (b) 73% solar contribution during observation period.
*15% wood contribution during observation period.
- (c) 6680 kW.h savings as a result of solar and wood contribution during observation period.

B. C. Hydro Representative

Ken Hodges/Gordon Trofananko
Kamloops, B. C.

* Wood stove was used in conjunction with electric baseboards heaters.
1200 lbs of alder used during observation period.

MILLIGAN RESIDENCE
VERNON, B. C.

1. Solar Space Heating System Details

- passive direct gain
- active air collectors
- rock bin storage.

2. House Details

(a) Floor Area:

Basement:	1350 ft ²
Main Floor:	1350 ft ²
Upper Floor:	<u>1100 ft²</u>
Total:	3800 ft ²

(b) Insulation

Ceiling:	R 40
Walls:	R 28

(c) Windows:

- double glazed.

(d) Doors:

- 2" insulated steel doors.

(e) Average Indoor Temperature

Daytime:	70°F
Nighttime:	65°F

(f) Backup Heating System:

- electric heat pump.

3. Solar Performance

- (a) Observation Period: 15 May 1980 - 15 May 1981.
- (b) 40% solar contribution during observation period.
- (c) 11,540 kW.h savings during observation period.

B. C. Hydro Representative

P. White
Vernon, B. C.

KNUEVER RESIDENCE
VERNON, B. C.

1. Solar Space Heating System Details

- passive direct gain.

2. House Details

(a) Floor Area: Total 3700 ft²

(b) Insulation
Ceiling: R 28
Walls: R 12

(c) Windows:
- triple glazed.

(d) Doors:
- 2" standard wooden doors (storm doors).

(e) Average Indoor Temperature
Daytime: 70°F
Nighttime: 65°F

(f) Backup Heating System:
- electric hydronic radiant floor heating system.

3. Solar Performance

(a) Observation Period: 5 August 1980 - 1 August 1981.

(b) 38% solar contribution during observation period.

(c) 17,630 kW.h savings during observation period.

B. C. Hydro Representative

P. White
Vernon, B. C.

DIXON RESIDENCE
FORT ST. JOHN, B. C.

1. Solar Space Heating System Details

- passive direct gain.

2. House Details

(a) Floor Area: Total 4100 ft²

(b) Insulation
Ceiling: R 48
Walls: R 24

(c) Windows:
- double and triple glazed ($\frac{1}{2}$ " air space, thermally broken).

(d) Doors:
- 2" standard wooden door (storm doors).

(e) Average Indoor Temperature
Daytime: 70°F
Nighttime: 70°F

(f) Backup Heating System:
- electrical baseboard heaters.

3. Solar Performance

(a) Observation Period: March 1980 - March 1981.

(b) * 67% solar contribution during observation period.

(c) * 33,300 kW.h savings during observation period.

B. C. Hydro Representative

Ian Gibson
Fort St. John, B. C.

* A wood burning stove was used in addition to solar to supplement the space heating requirements.

HATHAWAY RESIDENCE
PRINCE GEORGE, B. C.

1. Solar Space Heating System Details

- attached greenhouse
- water drum storage.

2. House Details

(a) Floor Area:

Main Floor:	1156 ft ²
Top Floor:	<u>1156 ft²</u>
Total:	2312 ft ²

(b) Insulation

Ceiling:	R 60
Walls:	R 40

(c) Windows:

- all double glazed ($\frac{1}{2}$ " air space, thermally broken).

(d) Doors:

- 2" standard wooden door (storm doors).

(e) Average Indoor Temperature

Daytime:	70°F
Nighttime:	65°F

(f) Backup Heating System:

- electrical baseboard heaters.

3. Solar Performance

(a) Observation Period: 17 January 1981 - 20 January 1982.

(b) 60% solar contribution during observation period.

(c) 6,460 kW.h savings during observation period.

B. C. Hydro Representative

Bill MacMillan
Prince George, B. C.

APPENDIX B

SOLAR CONTRIBUTIONS FOR SOLAR DOMESTIC
WATER HEATING APPLICATIONS

APPENDIX B

RECORDED AND PROCESSED DATA

Below are the names and locations of the 32 solar domestic water heating systems being monitored.

Metro

1. Chamber Residence - Burnaby
2. Hatfield Residence - Vancouver
3. Rennison Residence - Vancouver
4. Richardson Residence - Vancouver
5. Sloan Residence - Richmond
6. Logan Residence - Vancouver
7. Hill Residence - Burnaby
8. Hahn Residence - West Vancouver
9. Leekha Residence - Coquitlam
10. B. C. Hydro (Lochburn) - Burnaby
11. Twaite Residence - Vancouver
12. Clayard Residence - Sechelt
13. Community Alternatives Co-op, Vancouver
14. Hay Residence - Vancouver
15. SPEC - Vancouver
16. Smith Residence - Squamish

Fraser Valley

17. Hoffman Residence - Surrey
18. Horsfall Residence - Tsawwassen
19. Wagensten Residence - North Delta
20. Schultz Residence - Crescent Beach
21. Bjarnason Residence - White Rock
22. B. C. Hydro (R&D) - Surrey
23. Kartasheff Residence - Crescent Beach

Vancouver Island

24. Carter Residence - Victoria
25. MacIntosh Residence - Victoria
26. Douglas Residence - Victoria
27. Wilson Residence - Victoria
28. B. C. Hydro (Qualicum) - Qualicum

Southern Interior

29. Pineridge Elementary School - Kamloops
30. Rink Residence - Kamloops
31. Milligan Residence - Vernon

Central Interior

32. Hathaway Residence - Prince George

SOLAR DOMESTIC WATER HEATING SUMMARY

43% average annual solar contribution with an overall variation of 16% to 89%.

15,400 average litres of hot water consumption/residence/year.

3.5 occupants/residence.

System details of all solar domestic water heating systems on file are outlined in Table 3.

The average monthly solar contribution of the solar domestic water heating systems being monitored are given on the following pages.

Location		Building Type	Type	Solar System Details		System Installation Date
Region	City			Collector Make	Collector Area	
Metro	Burnaby	Home	CL ^{*1}	2 ^{*2}	60 ft ²	Jun/78
	Vancouver	Home	DB	3	54 ft ²	Nov/77
	Vancouver	Home	DB	5	96 ft ²	Oct/77
	Vancouver	Home	DB	5	72 ft ²	Nov/76
	Richmond	Home	DB	2	64 ft ²	May/79
	Vancouver	Home	TW	2	400 ft ²	Feb/80
	Burnaby	Home	DB	1	96 ft ²	Mar/80
	West Vanc	Home	CL	2	63 ft ²	Feb/80
	Coquitlam	Home	DB	1	704 ft ²	Jun/78
	Burnaby	Home	CL	7	126 ft ²	Jun/77
	Vancouver	Home	CL	2	60 ft ²	Sep/80
	Sechelt	Home	DD	8	64 ft ²	Feb/81
	Vancouver	Apt Bldg	DB	2	1386 ft ²	May/81
	Vancouver	Home	DB	1	72 ft ²	Apr/81
	Vancouver	Office	DB	2	36 ft ²	Nov/81
	Squamish	Home	CL	7	64 ft ²	Sep/81
Fraser Valley	Surrey	Home	DB	1	456 ft ²	Jun/70
	Tsawwassen	Home	DD	4	63 ft ²	Apr/79
	North Delta	Home	DB	1	96 ft ²	Oct/78
	Crescent Bch	Home	DB	5	96 ft ²	Nov/80
	White Rock	Home	DB	5	72 ft ²	Jul/80
	Surrey	R&D Facil	DB	1,7,9	600 ft ²	May/80
	Crescent Bch	Home	TS	2	80 ft ²	May/81
Vancouver Island	Victoria	Home	CL	6	74 ft ²	Jun/79
	Victoria	Home	DD	1	96 ft ²	Jul/81
	Victoria	Home	DD	2	96 ft ²	Oct/80
	Victoria	Home	DB	10	64 ft ²	Nov/80
	Qualicum	Office	CL	11	50 ft ²	Oct/81
Southern Interior	Kamloops	School	DB	1	128 ft ²	Oct/79
	Kamloops	Home	DB	6	96 ft ²	Jan/82
	Vernon	Home	DB	5	64 ft ²	Not Yet Installed
Central Interior	Pr George	Home	TS	6	50 ft ²	Feb/81

Table 3: Solar Domestic Water Heating System Details

*1 CL - closed loop system
 DD - drain down system
 DB - drain back system
 TS - thermosiphon system
 TW - trombe wall (hybrid system)

*2 1. Solar System Industries Ltd.
 2. Homemade
 3. Gruman Sunstream
 4. Thermo Solar
 5. Solway Ltd.
 6. Solar Systems in B. C. Book (workshop solar DHW system)
 7. Lennox
 8. Sunspot
 9. Miromit
 10. Ark Solar
 11. Petro Sun

CHAMBER RESIDENCE
BURNABY, B. C.

1. Solar Domestic Water Heating System Details

(a) System Type: Closed Loop

(b) Collector Details:

Make: Homemade
Area: 60 ft²
Slope: 45° (adjustable)
Azimuth: Due South

(c) Storage Tank Capacity: 50 Imperial Gallons

2. Backup Water Heating System Details

(a) Tank Capacity: 33 Imperial Gallons

(b) Hot Water Temperature: 110°F

(c) Energy Source: Natural Gas

3. Solar Performance

<u>1980</u>	<u>Energy Savings</u>	<u>% Solar</u>	<u>1981</u>	<u>Energy Savings</u>	<u>% Solar</u>
January	7.1	31	January	1.5	7
February	6.1	29	February	3.0	15
March	7.4	35	March	5.5	25
April	6.0	30	April	4.0	19
May	4.5	25	May	2.0	9
June	5.0	27	June	4.5	25
July	7.5	48	July	8.0	47
August	7.5	50	August	7.5	48
September	5.0	32	September	6.0	34
October	4.5	28	October	No Data	-
November	0.5	3	November	4.5	22
December	<u>1.5</u>	<u>7</u>	December	<u>0.5</u>	<u>24</u>
Yearly Total	62.6 therms	29% Avg	Yearly Total	47 therms	25% Avg

B. C. Hydro Representative

Don Hulme
Burnaby, B. C.

HATFIELD RESIDENCE
VANCOUVER, B. C.

1. Solar Domestic Water Heating System Details

(a) System Type: Drain Back

(b) Collector Details:

Make: Grumman Sunstream

Area: 54 ft²

Slope: 50°

Azimuth: 250° (70° west of due south)

(c) Storage Tank Capacity: 55 Imperial Gallons

2. Backup Water Heating System Details

(a) Tank Capacity: 40 Imperial Gallons

(b) Hot Water Temperature: 151°F

(c) Energy Source: Electric

3. Solar Performance

<u>1980</u>	<u>Energy Savings</u>	<u>% Solar</u>	<u>1981</u>	<u>Energy Savings</u>	<u>% Solar</u>
January	251 kW.h	31	January	300 kW.h	43
February	237	32	February	190	27
March	277	36	March	140	27
April	300	38	April	210	34
May	270	36	May	190	34
June	250	36	June	300	52
July	310	49	July	150	31
August	110	28	August	150	30
September	210	32	September	160	32
October	200	36	October	150	28
November	200	26	November	160	28
December	210	27	December	140	26
Yearly Total	2,825 kW.h	34% Avg	Yearly Total	2,240 kW.h	33% Avg

B. C. Hydro Representative

Don Hulme
Burnaby, B. C.

RENNISON RESIDENCE
VANCOUVER, B. C.

1. Solar Domestic Water Heating System Details

(a) System Type: Drain Back

(b) Collector Details:

Make: Solway

Area: 96 ft²

Slope: 60°

Azimuth: 225° (45° west of due south)

(c) Storage Tank Capacity: 100 Imperial Gallons

2. Backup Water Heating System Details

(a) Tank Capacity: 40 Imperial Gallons

(b) Hot Water Temperature: 117°F

(c) Energy Source: Electric

3. Solar Performance

<u>1980</u>	<u>Energy Savings</u>	<u>% Solar</u>	<u>1981</u>	<u>Energy Savings</u>	<u>% Solar</u>
January	19 kW.h	6	January	60 kW.h	14
February	67	18	February	90	20
March	170	39	March	230	46
April	180	44	April	270	38
May	160	37	May	230	35
June	100	29	June	110	36
July	220	63	July	200	55
August	180	64	August	190	63
September	160	54	September	110	30
October	110	31	October	110	30
November	30	6	November	0	-
December	0	-	December	40	18
Yearly Total	1,396 kW.h	36% Avg	Yearly Total	1,640 kW.h	35% Avg

B. C. Hydro Representative

Don Hulme
Burnaby, B. C.

RICHARDSON RESIDENCE
VANCOUVER, B. C.

1. Solar Domestic Water Heating System Details

(a) System Type: Drain Back

(b) Collector Details:

Make: Solway

Area: 72 ft²

Slope: 45°

Azimuth: Due South

(c) Storage Tank Capacity: 70 Imperial Gallons

2. Backup Water Heating System Details

(a) Tank Capacity: 33 Imperial Gallons

(b) Hot Water Temperature: 126°F

(c) Energy Source: Natural Gas

3. Solar Performance

<u>1980</u>	<u>Energy Savings</u>	<u>% Solar</u>	<u>1981</u>	<u>Energy Savings</u>	<u>% Solar</u>
January	5.1	21	January	4.5	17
February	10.1	33	February	8.5	37
March	9.5	37	March	9.5	38
April	10.5	44	May	8.0	34
May	9.5	39	May	8.0	33
June	8.5	40	June	1.0	6
July	12.5	52	July	12.5	50
August	12.0	54	August	19.0	67
September	11.5	50	September	14.0	51
October	4.5	20	October	7.5	25
November	3.5	16	November	.5	23
December	2.0	8	December	1.0	18
Yearly Total	99.2 therms	35% Avg	Yearly Total	94 therms	33% Avg

B. C. Hydro Representative

Don Hulme
Burnaby, B. C.

SLOAN RESIDENCE
RICHMOND, B. C.

1. Solar Domestic Water Heating System Details

(a) System Type: Drain Back

(b) Collector Details:

Make: Homemade
Area: 64 ft²
Slope: 30°
Azimuth: Due South

(c) Storage Tank Capacity: 100 Imperial Gallons

2. Backup Water Heating System Details

(a) Tank Capacity: 50 Imperial Gallons

(b) Hot Water Temperature: 130°F

(c) Energy Source: Electric

3. Solar Performance

<u>1980</u>	<u>Energy Savings</u>	<u>% Solar</u>	<u>1981</u>	<u>Energy Savings</u>	<u>% Solar</u>
			January	90 kW.h	38
			February	130	48
			March	150	57
			April	140	60
			May	170	67
June	170	71	June	190	77
July	160	67	July	190	78
August	160	62	August	190	78
September	140	68	September	180	66
October	130	54	October	140	50
November	80	36	November	100	49
December	70	29	December	60	30
Total	910 kW.h	55% Avg	Yearly Total	1,730 kW.h	58% Avg

B. C. Hydro Representative

Pat Nash
Richmond, B. C.

LOGAN RESIDENCE
VANCOUVER, B. C.

1. Solar Domestic Water Heating System Details

(a) System Type: Hybrid Trombe Wall (Air/water heat exchanger)

(b) Collector Details:

Make: Homemade
Area: 400 ft² Trombe Wall Area
Slope: 90°
Azimuth: Due South

(c) Storage Tank Capacity: 100 Imperial Gallons

2. Backup Water Heating System Details

(a) Tank Capacity: 33 Imperial Gallons

(b) Hot Water Temperature: 142°F

(c) Energy Source: Natural Gas

3. Solar Performance

<u>1980</u>	<u>Energy Savings</u>	<u>% Solar</u>	<u>1981</u>	<u>Energy Savings</u>	<u>% Solar</u>
			January	5.5	21
			February	6.0	27
			March	9.5	42
			April	No Data	No Data
May	6.5	29	May	"	"
June	7.5	31	June	"	"
July	10.5	54	July	"	"
August	9.0	34	August	"	"
September	8.5	38	September	"	"
October	8.5	33	October	"	"
November	6.0	21	November	"	"
December	3.0	10	December	"	"
			Yearly		
Total	60 therms	31% Avg	Total	21 therms	30% Avg

4. Comments

Provisions have been made to remove the information meters.

B. C. Hydro Representative

Don Hulme
Burnaby, B. C.

HILL RESIDENCE
BURNABY, B. C.

1. Solar Domestic Water Heating System Details

(a) System Type: Drain Back

(b) Collector Details:

Make: Solar Systems Ind.

Area: 96 ft²

Slope: 35°

Azimuth: Due South

(c) Storage Tank Capacity: 100 Imperial Gallons

2. Backup Water Heating System Details

(a) Tank Capacity: 40 Imperial Gallons

(b) Hot Water Temperature: 120°F

(c) Energy Source: Electric

3. Solar Performance

<u>1980</u>	<u>Energy Savings</u>	<u>% Solar</u>	<u>1981</u>	<u>Energy Savings</u>	<u>% Solar</u>
			January	70	21
			February	90	31
March	140	54	March	210	60
April	180	68	April	170	56
May	190	66	May	200	60
June	150	65	June	210	62
July	160	85	July	200	76
August	240	84	August	240	83
September	200	65	September	220	71
October	200	69	October	140	48
November	100	27	November	120	36
December	50	17	December	90	29
			Yearly		
Total	1,610 kW.h	60% Avg	Total	1,960 kW.h	53% Avg

B. C. Hydro Representative

Don Hulme
Burnaby, B. C.

HAHN RESIDENCE
WEST VANCOUVER, B. C.

1. Solar Domestic Water Heating System Details

(a) System Type: Closed Loop

(b) Collector Details:

Make: Homemade
Area: 63 ft²
Slope: 5°
Azimuth: Due South

(c) Storage Tank Capacity: 80 Imperial Gallons

2. Backup Water Heating System Details

(a) Tank Capacity: 40 Imperial Gallons

(b) Hot Water Temperature: 135°F

(c) Energy Source: Electric

3. Comments

Solar system operated only during the spring, summer and fall.

4. Solar Performance

<u>1980</u>	<u>Energy Savings</u>	<u>% Solar</u>	<u>1981</u>	<u>Energy Savings</u>	<u>% Solar</u>
			April	140 kW.h	18
			May	200	28
			June	190	28
July	310 kW.h	63	July	260	37
August	320	53	August	210	51
September	60	11	September	140	53
October	20	4	October	80	16
Total	710 kW.h	33% Avg	Total	1,220 kW.h	33% Avg

B. C. Hydro Representative

Jack Doherty
North Vancouver, B. C.

LEEKHA RESIDENCE
COQUITLAM, B. C.

1. Solar Domestic Water Heating System Details

(a) System Type: Drain Back

(b) Collector Details:

Make: Solar Systems Ind.

Area: 384 ft² (east) 320 ft² (south west)

Slope: 50°

(c) Storage Tank Capacity: 4,000 Imperial Gallons

2. Backup Water Heating System Details

(a) Tank Capacity: 33 Imperial Gallons

(b) Hot Water Temperature: 135°F

(c) Energy Source: Natural Gas

3. Solar Performance

<u>1980</u>	<u>Energy Savings</u>	<u>% Solar</u>	<u>1981</u>	<u>Energy Savings</u>	<u>% Solar</u>
			January	7.5 therms	24)
			February	7.5)	24)
			March	7.5) Avg	24) Avg
			April	7.5) Taken	24) Taken
			May	7.5)	24)
			June	7.5)	24)
			July	43	83
			August	30	84
			September	26	72
			October	30	75
November	4 therms	15	November	22	44
December	7.5	24	December	10	23
Total	11.5	19.5% Avg	Yearly Total	206 therms	44% Avg

B. C. Hydro Representative

Peter Valkenburg
Coquitlam, B. C.

B. C. HYDRO
LOCHBURN

1. Solar Domestic Water Heating System Details

(a) System Type: Closed Loop

(b) Collector Details:

Make: Lennox
Area: 126 ft²
Slope: 50°
Azimuth: Due South

(c) Storage Tank Capacity: 120 U.S. Gallons

2. Backup Water Heating System Details

(a) Tank Capacity: 85 U.S. Gallons

(b) Hot Water Temperature: 125°F

(c) Energy Source: Electric

3. Solar Performance

<u>1980</u>	<u>Energy Savings</u>	<u>% Solar</u>	<u>1981</u>	<u>Energy Savings</u>	<u>% Solar</u>
January	144 kW.h	33	January	*1	*1
February	272	41	February		
March	468	41	March		
April	427	48	April		
May	296	44	May		
June	595	48	June		
July	226	25	July		
August	200	27	August		
September	645	55	September		
October	529	49	October		
November	*1	*1	November		
December	*1	*1	December	—	—
Total	3,802 kW.h	41% Avg	Yearly Total	-	-

*1 Due to a malfunction in the bypass solenoid valve, the energy utilization data recorded after November 1980 was inconclusive.

B. C. Hydro Representative

Jack Clarke
Lochburn

TWAITES RESIDENCE
VANCOUVER, B. C.

1. Solar Domestic Water Heating System Details

(a) System Type: Closed Loop

(b) Collector Details:

Make: Homemade
Area: 60 ft²
Slope: 30°
Azimuth: Due South

(c) Storage Tank Capacity: 75 Imperial Gallons

2. Backup Water Heating System Details

(a) Tank Capacity: 33 Imperial Gallons

(b) Hot Water Temperature: 138°F

(c) Energy Source: Natural Gas

3. Solar Performance

<u>1980</u>	<u>Energy Savings</u>	<u>% Solar</u>	<u>1981</u>	<u>Energy Savings</u>	<u>% Solar</u>
			January	6 therms	12
			February	7)	13
			March	7) Avg	13
			April	8	13
			May	11	17
			June	11)	18
			July	11) Avg	18
			August	27.5	45
September	9.5	24	September	13.5	27
October	8.5	19	October	5.5	6
November	5.0	10	November	3.5	8
December	5.5	10	December	0	0
			Yearly		
Total	28.5 therms	16% Avg	Total	111 therms	16% Avg

B. C. Hydro Representative

Don Hulme
Burnaby, B. C.

CLAYARD RESIDENCE
SECHELT, B. C.

1. Solar Domestic Water Heating System Details

- (a) System Type: Drain Down
- (b) Collector Details:
Make: Sunspot
Area: 64 ft²
Slope: 42°
Azimuth: 176° (4° east of due south)
- (c) Storage Tank Capacity: 80 Imperial Gallons

2. Backup Water Heating System Details

- (a) Tank Capacity: 40 Imperial Gallons
- (b) Hot Water Temperature: 136°F
- (c) Energy Source: Electric

3. Solar Performance

<u>1981</u>	<u>Energy Savings</u>	<u>% Solar</u>
March	110 kW.h	58%
April	230	57
May	140	34
June	230	59
July	310	90
August	360	92
September	210	64
October	140	40
November	265	29
December	265	29
	} Avg	
	} Avg	
Total	2,260 kW.h	55% Avg

B. C. Hydro Representative

Eric Dermont
Sechelt, B. C.

COMMUNITY ALTERNATIVES CO-OP
VANCOUVER, B. C.

1. Solar Domestic Water Heating System Details

(a) System Type: Drain Back

(b) Collector Details:

Make: Homemade

Area: 1,386 ft² (44 collectors x 4½' x 7')

Slope: 60° (29 collectors), 30° (15 collectors)

Azimuth: Due South

(c) Storage Tank Capacity: 3 x 500 Imperial Gallons

2. Backup Water Heating System Details

(a) Tank Capacity: 2 x 63.8 Imperial Gallons

(b) Hot Water Temperature: 130°F

(c) Energy Source: Natural Gas

3. Comments

- System installed spring of 1981.

- Because of start-up problems encountered, no reliable energy utilization data is available for 1981.

B. C. Hydro Representative

Don Hulme
Burnaby, B. C.

HAY RESIDENCE
VANCOUVER, B. C.

1. Solar Domestic Water Heating System Details

- (a) System Type: Drain Back
- (b) Collector Details:
 - Make: Solar Systems Ind.
 - Area: 72 ft²
 - Slope: 44°
 - Azimuth: 150° (30° east of due south)
- (c) Storage Tank Capacity: 100 Imperial Gallons

2. Backup Water Heating System Details

- (a) Tank Capacity: 33 Imperial Gallons
- (b) Hot Water Temperature: 130°F
- (c) Energy Source: Natural Gas

3. Comments

- System installed May 1981 and is part of our CR 21 Datalogger Monitoring Program.
- A 12-month summary of the system performance will be made available in next year's annual solar monitoring summary.

B. C. Hydro Representative

Don Hulme
Burnaby, B. C.

SOCIETY PROMOTING ENVIRONMENTAL CONSERVATION (SPEC)
VANCOUVER, B. C.

1. Solar Domestic Water Heating System Details

(a) System Type: Drain Back

(b) Collector Details:

Make: Solar Systems Ind.

Area: 36 ft²

Slope: 50°

Azimuth: Due South

(c) Storage Tank Capacity: 80 Imperial Gallons

2. Backup Water Heating System Details

(a) Tank Capacity: 33 Imperial Gallons

(b) Hot Water Temperature: 120°F

(c) Energy Source: Natural Gas

3. Comments

- System installed during the fall of 1981.
- Information metering installed December 1981.
- No energy utilization data available for 1981.

B. C. Hydro Representative

Don Hulme
Burnaby, B. C.

SMITH RESIDENCE
SQUAMISH, B. C.

1. Solar Domestic Water Heating System Details

- (a) System Type: Closed Loop
- (b) Collector Details:
 - Make: Lennox
 - Area: 64 ft²
 - Slope: 45°
 - Azimuth: Due South
- (c) Storage Tank Capacity: 60 Imperial Gallons

2. Backup Water Heating System Details

- (a) Tank Capacity: 12 Imperial Gallons
- (b) Hot Water Temperature: 160°F
- (c) Energy Source: Electric

3. Comments

- System installed during the fall of 1981.
- Information metering installed January 1982.
- No energy utilization data available for 1981.

B. C. Hydro Representative

Leroy Watt
Squamish, B. C.

HOFFMAN RESIDENCE
SURREY, B. C.

1. Solar Domestic Water Heating System Details

(a) System Type: Drain Back

(b) Collector Details:

Make: Solar Systems Ind.
Area: 456 ft²
Slope: 58°
Azimuth: Due South

(c) Storage Tank Capacity: 800 Imperial Gallons

2. Backup Water Heating System Details

(a) Tank Capacity: 40 Imperial Gallons

(b) Hot Water Temperature: 136°F

(c) Energy Source: Electric

3. Solar Performance

<u>1980</u>	<u>Energy Savings</u>	<u>% Solar</u>	<u>1981</u>	<u>Energy Savings</u>	<u>% Solar</u>
January	200)	40)	January	200	45
February	180) Avg	40) Avg	February	190	47
March	200)	40)	March	400	68
April	310)	69)	April	370	74
May	300) Avg	71) Avg	May	220	64
June	290)	71)	June	220	66
July	310	72	July	230	67
August	280	70	August	360	72
September	300	69	September	no data	no data
October	230	52	October	"	"
November	160) Avg	37) Avg	November	"	"
December	160)	37)	December	"	"
Yearly Total	2,920 kW.h	56% Avg	Total	2,190 kW.h	63% Avg

4. Comments

Provisions have been made to remove the information meters.

B. C. Hydro Representative

Cliff Melin
Surrey, B. C.

HORSFALL RESIDENCE
TSAWWASSEN, B. C.

1. Solar Domestic Water Heating System Details

(a) System Type: Closed Loop

(b) Collector Details:

Make: Thermo Solar

Area: 63 ft²

Slope: 50°

Azimuth: Due South

(c) Storage Tank Capacity: 80 Imperial Gallons

2. Backup Water Heating System Details

(a) Tank Capacity: 40 Imperial Gallons

(b) Hot Water Temperature: 126°F

(c) Energy Source: Electric

3. Comments

- Monthly readings for 1981 were not obtained, so annual average figures were calculated.

4. Solar Performance

<u>1980</u>	<u>Energy Savings</u>	<u>% Solar</u>	<u>1981</u>	<u>Energy Savings</u>	<u>% Solar</u>
January	161 kW.h	33	January	321 kW.h	59)
February	315	47	February	321)	59)
March	599	63	March	321)	59)
April	490	78	April	321)	59)
May	470	72	May	321)	59)
June	420	69	June	321)	59)
July	480	84	July	321)	59)
August	450	89	August	321)	59)
September	370	77	September	321)	59)
October	260	61	October	321)	59)
November	150	33	November	321)	59)
December	90	25	December	321)	59)
Yearly			Yearly		
Total	4,255 kW.h	61% Avg	Total	3,850 kW.h	59% Avg

B. C. Hydro Representative

Don Rankin
Fraser Valley Gas
Surrey, B. C.

WAGENSTEN RESIDENCE
NORTH DELTA, B. C.

1. Solar Domestic Water Heating System Details

- (a) System Type: Drain Down
- (b) Collector Details:
 - Make: Solar Systems Ind.
 - Area: 96 ft²
 - Slope: 50°
 - Azimuth: Due South
- (c) Storage Tank Capacity: 100 Imperial Gallons

2. Backup Water Heating System Details

- (a) Tank Capacity: 33 Imperial Gallons
- (b) Hot Water Temperature: 140°F
- (c) Energy Source: Gas

3. Comments

- Information metering has been installed for over a year.
- Customer has irregular work hours and schedules and because of this, it was difficult to get information meter readings.
- Any readings that were received, were inconclusive.
- Provisions have been made to remove the information meters.

B. C. Hydro Representative

Cliff Melin
Surrey, B. C.

SCHULTZ RESIDENCE
CRESCENT BEACH, B. C.

1. Solar Domestic Water Heating System Details

(a) System Type: Drain Back

(b) Collector Details:

Make: Solway

Area: 96 ft²

Slope: 50°

Azimuth: 225° (45° west of due south)

(c) Storage Tank Capacity: 100 Imperial Gallons

2. Backup Water Heating System Details

(a) Tank Capacity: 60 Imperial Gallons

(b) Hot Water Temperature: 115°F

(c) Energy Source: Electric

3. Solar Performance

<u>1981</u>	<u>Energy Savings</u>	<u>% Solar</u>
February	70 kW.h	52%
March	120	53
April	80	41
May	120	50
June	110	49
July	110	48
August	110	48
September	140	56
October	70	32
November	90	47
December	20	52
Total	1,040 kW.h	48% Avg

B. C. Hydro Representative

Cliff Melin
Surrey, B. C.

BJARNASON RESIDENCE
WHITE ROCK, B. C.

1. Solar Domestic Water Heating System Details

(a) System Type: Drain Back

(b) Collector Details:

Make: Solway
Area: 72 ft²
Slope: 35°
Azimuth: Due South

(c) Storage Tank Capacity: 100 Imperial Gallons

2. Backup Water Heating System Details

(a) Tank Capacity: 42 Imperial Gallons

(b) Hot Water Temperature: 138°F

(c) Energy Source: Natural Gas

3. Solar Performance

<u>1980</u>	<u>Energy Savings</u>	<u>% Solar</u>	<u>1981</u>	<u>Energy Savings</u>	<u>% Solar</u>
			January	9.5	35
			February	13.5	55
			March	16.5	50
			April	17	60
			May	19	66
			June	17.5	63
			July	20.5	73
August	21	76	August	23.5	82
September	19	67	September	16.5	64
October	14.5	56	October	13	50
November	14.5	58	November	13	49
December	9.5	32	December	8	28
Total	78.5 therms	58% Avg	Yearly Total	187.5 therms	56% Avg

B. C. Hydro Representative

Cliff Melin
Surrey, B. C.

B. C. HYDRO
RESEARCH & DEVELOPMENT FACILITIES
SURREY, B. C.

1. Solar Domestic Water Heating System Details

(a) System Type: Drain Back

(b) Collector Details:

Make: Solar Systems Ind./Lennox/Miromit
Area: 200 ft²/200 ft²/200 ft²
Slope: 50°
Azimuth: Due South

(c) Storage Tank Capacity: 660 Imperial Gallons

2. Backup Water Heating System Details

(a) Tank Capacity: 840 Imperial Gallons

(b) Hot Water Temperature: 120°F

(c) Energy Source: Electric

3. Comments*

- Most of the initial startup problems have now been resolved.
- Because of some transducers and sensors that were faulty, some of the vital system variables could not be measured. (i.e. cold water makeup, which represents the actual hot water consumption in the R&D Facilities).

B. C. Hydro Representative

D. Pugh
Surrey, B. C.

* See Section 2.6.1 for further information.

KARTASHEFF RESIDENCE
CRESCENT BEACH, B. C.

1. Solar Domestic Water Heating System Details

- (a) System Type: Thermosiphon
- (b) Collector Details:
 - Make: Homemade
 - Area: 80 ft²
 - Slope: 74°
 - Azimuth: 160° (20° east of due south)
- (c) Storage Tank Capacity: 92 Imperial Gallons

2. Backup Water Heating System Details

- (a) Tank Capacity: 42 Imperial Gallons
- (b) Hot Water Temperature: 140°F
- (c) Energy Source: Natural Gas

3. Comments

- Solar system was partially installed during May 1981.
- Solar system was completely installed during the fall of 1981.
- Information metering installed at the end of 1981.
- No energy utilization data available for 1981.

B. C. Hydro Representative

Cliff Melin
Surrey, B. C.

CARTER RESIDENCE
VICTORIA, B. C.

1. Solar Domestic Water Heating System Details

(a) System Type: Closed Loop

(b) Collector Details:

Make: Homemade (Solar Systems in B. C. Book)

Area: 74 ft²

Slope: 50°

Azimuth: Due South

(c) Storage Tank Capacity: 65 Imperial Gallons

2. Backup Water Heating System Details

(a) Tank Capacity: 40 Imperial Gallons

(b) Hot Water Temperature: 130°F

(c) Energy Source: Electric

3. Solar Performance

<u>1980</u>	<u>Energy Savings</u>	<u>% Solar</u>	<u>1981</u>	<u>Energy Savings</u>	<u>% Solar</u>
January	234 kW.h	34	January	110 kW.h	23
February	308	50	February	120	31
March	342	58	March	190	44
April	260	59	April	180	49
May	260	56	May	150	49
June	260	58	June	130	52
July	250	66	July	120	55
August	170	62	August	120	55
September	200	58	September	130	52
October	270	55	October	90	52
November	240	48			
December	100	22			
Yearly					
Total	2,894 kW.h	52% Avg	Total	1,340 kW.h	46% Avg

4. Comments

- Mr. Carter dropped out of our Solar Monitoring Program as of November 1981.
- Provisions have been made to remove the information meters.

B. C. Hydro Representative

G. Sadler
Victoria, B. C.

MacINTOSH RESIDENCE
VICTORIA, B. C.

1. Solar Domestic Water Heating System Details

(a) System Type: Drain Down

(b) Collector Details:

Make: Solar Systems Ind.

Area: 96 ft²

Slope: 40°

Azimuth: 170° (10° east of due south)

(c) Storage Tank Capacity: 100 Imperial Gallons

2. Backup Water Heating System Details

(a) Tank Capacity: 60 Imperial Gallons

(b) Hot Water Temperature: 140°F

(c) Energy Source: Electric

3. Solar Performance

<u>1981</u>	<u>Energy Savings</u>	<u>% Solar</u>	
August	238 kW.h	36	} Avg
September	238	36	
October	161	24	
November	205	24	
December	262	17	
Total	1,104 kW.h	27% Avg	

B. C. Hydro Representative

G. Sadler
Victoria, B. C.

DOUGLAS RESIDENCE
VICTORIA, B. C.

1. Solar Domestic Water Heating System Details

(a) System Type: Drain Down

(b) Collector Details:

Make: Homemade

Area: 96 ft²

Slope: 60°

Azimuth: 170° (10° east of due south)

(c) Storage Tank Capacity: 250 Imperial Gallons

2. Backup Water Heating System Details

(a) Tank Capacity: 40 Imperial Gallons

(b) Hot Water Temperature: 155°F

(c) Energy Source: Electric

3. Solar Performance

<u>1981</u>	<u>Energy Savings</u>	<u>% Solar</u>
January	0 kW.h	0
February	0	0
March	80	16
April	15)	3)
May	15) Avg	3) Avg
June	20	3
July	120	18
August	290	41
September	210	38
October	40)	9)
November	40) Avg	9) Avg
December	30	8
Yearly Total	770 kW.h	11% Avg

B. C. Hydro Representative

G. Sadler
Victoria, B. C.

WILSON RESIDENCE
VICTORIA, B. C.

1. Solar Domestic Water Heating System Details

- (a) System Type: Drain Back
- (b) Collector Details:
Make: Ark Solar
Area: 64 ft²
Slope: 55°
Azimuth: 190° (10° west of south)
- (c) Storage Tank Capacity: 100 Imperial Gallons

2. Backup Water Heating System Details

- (a) Tank Capacity: 60 Imperial Gallons
- (b) Hot Water Temperature: 126°F
- (c) Energy Source: Electric

3. Solar Performance

<u>1981</u>	<u>Energy Savings</u>	<u>% Solar</u>
February	50 kW.h	29
March	70	29
April	120	42
May	160	52
June	180	57
July	180	61
August	100	47
September	-	-
October	70	35
November	90	37
December	70	36
Total	1,090 kW.h	43% Avg

B. C. Hydro Representative

G. Sadler
Victoria, B. C.

B. C. HYDRO
QUALICUM DISTRICT OFFICE
QUALICUM, B. C.

1. Solar Domestic Water Heating System Details

(a) System Type: Closed Loop

(b) Collector Details:

Make: Petro Sun

Area: 50 ft²

Slope: 50°

Azimuth: Due South

(c) Storage Tank Capacity: 80 U.S. Gallons

2. Backup Water Heating System Details

(a) Tank Capacity: 25 U.S. Gallons

(b) Hot Water Temperature: 140°F

(c) Energy Source: Electric

3. Comments

- Solar DHW system installed in the fall of 1981.
- Insufficient energy utilization data for 1981.

B. C. Hydro Representative

J. Kennaird
Qualicum, B. C.

PINERIDGE ELEMENTARY SCHOOL
KAMLOOPS, B. C.

1. Solar Domestic Water Heating System Details

(a) System Type: Drain Back

(b) Collector Details:

Make: Solar Systems Ind.

Area: 128 ft²

Slope: 55°

Azimuth: Due South

(c) Storage Tank Capacity: 200 Imperial Gallons

2. Backup Water Heating System Details

(a) Tank Capacity: 66 Imperial Gallons

(b) Hot Water Temperature: 120°F

(c) Energy Source: Natural Gas

3. Comments

- Solar DHW heating system installed in the fall of 1979.
- Hydro information metering installed in February 1980.
- The hot water usage demand of the school is quite low, (approximately 5 Imperial gallons per day averaged over the month), resulting in high standby losses in the hot water heating system. Because of this it was very difficult to determine the backup heater efficiency and thus prohibited us from calculating an accurate percent solar contribution figure.
- Provisions have been made to remove the information meters.

B. C. Hydro Representative

Ken Hodges/Gordon Trofananko
Kamloops, B. C.

RINK RESIDENCE
KAMLOOPS, B. C.

1. Solar Domestic Water Heating System Details

(a) System Type: Drain Back

(b) Collector Details:

Make: Homemade (Solar Systems in B. C. Book)

Area: 96 ft²

Slope: 50°

Azimuth: Due South

(c) Storage Tank Capacity: 100 Imperial Gallons

2. Backup Water Heating System Details

(a) Tank Capacity: 40 Imperial Gallons

(b) Hot Water Temperature: 140°F

(c) Energy Source: Electric

3. Solar Performance

<u>1981</u>	<u>Energy Savings</u>	<u>% Solar</u>
May	1,522 kW.h	90
June	1,005	90
July	1,050	93
August	1,084	94
September	1,127	91
October	537	85
November	893	86
December	617	82
Total	7,835 kW.h	89% Avg

B. C. Hydro Representative

Ken Hodges/Gordon Trofananko
Kamloops, B. C.

MILLIGAN RESIDENCE
VERNON, B. C.

1. Solar Domestic Water Heating System Details

(a) System Type: Drain Back

(b) Collector Details:

Make: Solway

Area: 64 ft²

Slope: 50°

Azimuth: Due South

(c) Storage Tank Capacity: 100 Imperial Gallons

2. Backup Water Heating System Details

(a) Tank Capacity: 40 Imperial Gallons

(b) Hot Water Temperature: 140°F

(c) Energy Source: Electric

3. Comments

- kW.h information meter installed April 1981.
- Water meter not yet installed (customer said that he would install).
- Solar DHW system not yet installed.
- No energy utilization data for 1981.

B. C. Hydro Representative

Pat White
Vernon Regional Office

HATHAWAY RESIDENCE
PRINCE GEORGE, B. C.

1. Solar Domestic Water Heating System Details

(a) System Type: Thermosiphon

(b) Collector Details:

Make: Homemade (Solar Systems in B. C. Book)

Area: 50 ft²

Slope: 60°

Azimuth: Due South

(c) Storage Tank Capacity: 60 Imperial Gallons

2. Backup Water Heating System Details

(a) Tank Capacity: 40 Imperial Gallons

(b) Hot Water Temperature: 140°F

(c) Energy Source: Electric

3. Comments

- kW.h information meter installed March 1981 (bi-monthly readings taken).
- Water information meter not yet installed.

4. Solar Performance

<u>1981</u>	<u>* Energy Savings</u>	<u>* % Solar</u>
April	213 kW.h	39
May		
June	333	63
July		
August	407	77
September		
October	219	44
November		
December	224	41
Jan/1982		
Total	1,396 kW.h	53%

* Since water meter not yet installed, assumption of 24 Imperial gallons of hot water usage per day (two adult occupants).

B. C. Hydro Representative

Bill MacMillan
Prince George, B. C.

APPENDIX C

SOLAR CONTRIBUTIONS FOR SOLAR
POOL HEATING APPLICATIONS

APPENDIX C

RECORDED AND PROCESSED DATA

Below are the names and locations of the 18 solar pool heating systems being monitored.

Metro

1. Chambers Residence - Burnaby
2. Myhers Residence - Vancouver
3. Shives Residence - West Vancouver
4. Wright Residence - Burnaby
5. Williamson Residence - West Vancouver
6. Harris Residence - West Vancouver
7. Taschuk Residence - Burnaby
8. Watt Residence - West Vancouver
9. McElhoses Residence - Richmond
10. Hill Residence - Richmond
11. Binns Residence - Burnaby
12. Hurd Residence - Coquitlam
13. Webb Residence - Coquitlam

Fraser Valley

14. Cayer Residence - Surrey
15. Greaves Residence - Langley
16. Pelton Residence - Maple Ridge
17. LeHay Residence - Langley
18. Weaver Residence - Surrey

SOLAR POOL HEATING SUMMARY

Outdoor Pools

51% average seasonal solar contribution with an overall variation of 13% to 96% (outdoor swimming pool heating season usually from May - September).

The average seasonal solar contribution of the solar assisted outdoor pool heating systems being monitored are given on the following pages.

Indoor Pools

65% average seasonal solar contribution with an overall variation of 45% to 92% (indoor swimming pool heating season usually from February to November).

The average seasonal solar contribution of the solar assisted indoor pool heating systems being monitored are given on the following pages.

System details of all solar pool heating systems on file are outlined in Table 4.

Location		Bldg Type	Solar System Details		Pool Details			System Install Date
Region	City		Collector Make	Collector Area (ft ²)	Type	Area (ft ²)	Pool Cover	
Metro	Burnaby	Home	2*2	432	O.I.*1	684	No	Jun/78
	Vancouver	Home	1	360	O.I.	512	No	Jul/78
	West Vanc	Home	1	240	I.I.	560	Yes	Jun/78
	Burnaby	Home	4	200	O.I.	392	Yes	Mar/80
	West Vanc	Home	1	480	O.I.	880	Yes	Mar/79
	West Vanc	Home	4	200	O.I.	540	Yes	Mar/80
	Burnaby	Home	1	320	O.I.	512	No	Jul/79
	West Vanc	Home	4	300	O.I.	648	Yes	May/80
	Richmond	Home	3	616	O.I.	800	No	May/80
	Richmond	Home	1	256	O.I.	550	Yes	Oct/79
	Burnaby	Home	2	120	O.I.	648	No	Aug/81
	Coquitlam	Home	1	384	O.I.	512	No	Jul/81
	Coquitlam	Home	1	280	I.I.	630	Yes	Nov/79
Fraser Valley	Surrey	Home	1	400	O.I.	648	Yes	Mar/78
	Langley	Home	1	320	O.I.	512	Yes	Sep/77
	Maple Ridge	Home	1	320	O.I.	684	Yes	Nov/77
	Langley	Home	2	144	O.I.	800	Yes	Mar/78
	Surrey	Home	1	256	O.I.	684	Yes	Nov/81

Table 4: Solar Pool Heating System Details

*1 I.I. - indoor and inground
O.I. - outdoor and inground

*2 1. Fafco
2. Homemade
3. Solaroll
4. Souris System

CHAMBERS RESIDENCE
BURNABY, B. C.

1. Solar Pool Heating System Details

(a) Collector Details:

Make: Homemade (Trickle)
Area: 432 ft²
Slope: 8°
Azimuth: Due South

(b) Pool Details:

Type: Outdoor Inground
Area: 684 ft²
Capacity: 18,000 Imperial Gallons
Backup Heater: Natural Gas
Pool Cover Used: No

2. Solar Performance

1980

May 2/80 - Sept 1/80 1,560 therms savings
Pool Water Temperature: 79°F 96% solar contribution

1981

Jun 8/81 - Sept 15/81 921 therms savings
Pool Water Temperature: 79°F 79% solar contribution

B. C. Hydro Representative

Don Hulme
Burnaby, B. C.

MYHERS RESIDENCE
VANCOUVER, B. C.

1. Solar Pool Heating System Details

(a) Collector Details:

Make: Fafco
Area: 360 ft²
Slope: 30°
Azimuth: Due South

(b) Pool Details:

Type: Outdoor Inground
Area: 512 ft²
Capacity: 13,000 Imperial Gallons
Backup Heater: Natural Gas
Pool Cover Used: No

2. Solar Performance

1980

May 15/80 - Sept 1/80	712 therms savings
Pool Water Temperature: 80°F	64% solar contribution

1981

- Did not operate during 1981.

B. C. Hydro Representative

Don Hulme
Burnaby, B. C.

SHIVES RESIDENCE
WEST VANCOUVER, B. C.

1. Solar Pool Heating System Details

(a) Collector Details:

Make: Fafco
Area: 320 ft²
Slope: 30°
Azimuth: Due South

(b) Pool Details:

Type: Indoor Inground
Area: 560 ft²
Capacity: 14,000 Imperial Gallons
Backup Heater: Natural Gas
Pool Cover Used: Yes

2. Solar Performance

1980

Jan 2/80 - Jan 1/81	2260 therms savings
Pool Water Temperature: 81°F	45% solar contribution

1981

Jan 1/81 - Nov 1/81	2450 therms savings
Pool Water Temperature: 81°F	59% solar contribution

B. C. Hydro Representative

Jack Doherty
North Vancouver, B. C.

WRIGHT RESIDENCE
BURNABY, B. C.

1. Solar Pool Heating System Details

(a) Collector Details:

Make: Souris System SP77
Area: 200 ft²
Slope: 25°
Azimuth: 90° (due east)

(b) Pool Details:

Type: Outdoor Inground
Area: 392 ft²
Capacity: 10,000 Imperial Gallons
Backup Heater: Natural Gas
Pool Cover Used: Yes

2. Solar Performance

1980

Apr 28/80 - Oct 1/80	67 therms savings
Pool Water Temperature: 78°F	13% solar contribution

1981

May 21/81 - Sept 30/81	142 therms savings
Pool Water Temperature: 78°F	34% solar contribution

B. C. Hydro Representative

Don Hulme
Burnaby, B. C.

WILLIAMSON RESIDENCE
WEST VANCOUVER, B. C.

1. Solar Pool Heating System Details

(a) Collector Details:

Make: Fafco
Area: 480 ft²
Slope: 30°
Azimuth: Due South

(b) Pool Details:

Type: Outdoor Inground
Area: 880 ft²
Capacity: 22,000 Imperial Gallons
Backup Heater: Natural Gas
Pool Cover Used: Yes

2. Solar Performance

1980

May 31/80 - Oct 1/80	190 therms savings
Pool Water Temperature: 79°F	26% solar contribution

1981

Apr 24/81 - Sept 18/81	173 therms savings
Pool Water Temperature: 80°F	17% solar contribution

B. C. Hydro Representative

J. Doherty
North Vancouver, B. C.

HARRIS RESIDENCE
WEST VANCOUVER, B. C.

1. Solar Pool Heating System Details

(a) Collector Details:

Make: Souris System SP77
Area: 200 ft²
Slope: 30°
Azimuth: 225° (45° west of due south)

(b) Pool Details:

Type: Outdoor Inground
Area: 540 ft²
Capacity: 13,500 Imperial Gallons
Backup Heater: Natural Gas
Pool Cover Used: Yes

2. Solar Performance

1980

May 30/80 - Oct 9/80	690 therms savings
Pool Water Temperature: 80°F	51% solar contribution

1981

May 11/81 - Aug 22/81	500 therms savings
Pool Water Temperature: 80°F	45% solar contribution

B. C. Hydro Representative

J. Doherty
North Vancouver, B. C.

TASCHUK RESIDENCE
BURNABY, B. C.

1. Solar Pool Heating System Details

(a) Collector Details:

Make: Fafco
Area: 320 ft²
Slope: 20°
Azimuth: Due South

(b) Pool Details:

Type: Outdoor Inground
Area: 512 ft²
Capacity: 13,000 Imperial Gallons
Backup Heater: Natural Gas
Pool Cover Used: No

2. Solar Performance

1980

Jul 30/80 - Sept 6/80	175 therms savings
Pool Water Temperature: 82°F	49% solar contribution

1981

May 1/81 - Sept 15/81	982 therms savings
Pool Water Temperature: 82°F	56% solar contribution

B. C. Hydro Representative

Don Hulme
Burnaby, B. C.

WATT RESIDENCE
WEST VANCOUVER, B. C.

1. Solar Pool Heating System Details

(a) Collector Details:

Make: Souris System SP77
Area: 300 ft²
Slope: 10°
Azimuth: 202.5° (22½° west of due south)

(b) Pool Details:

Type: Outdoor Inground
Area: 648 ft²
Capacity: 16,200 Imperial Gallons
Backup Heater: Natural Gas
Pool Cover Used: Yes

2. Solar Performance

1980

Jun 30/80 - Sept 9/80	140 therms savings
Pool Water Temperature: 82°F	23% solar contribution

1981

- Did not operate in 1981.

B. C. Hydro Representative

J. Doherty
North Vancouver, B. C.

McELHOES RESIDENCE
RICHMOND, B. C.

1. Solar Pool Heating System Details

(a) Collector Details:

Make: Solaroll
Area: 616 ft²
Slope: 5°
Azimuth: Due South

(b) Pool Details:

Type: Outdoor Inground
Area: 800
Capacity: 20,000 Imperial Gallons
Backup Heater: Natural Gas
Pool Cover Used: No

2. Solar Performance

1980

Jun 29/80 - Sept 1/80

691 therms savings

Pool Water Temperature: 82°F

66% solar contribution

1981

- Did not operate in 1981.

B. C. Hydro Representative

Pat Nash
Richmond, B. C.

HILL RESIDENCE
RICHMOND, B. C.

1. Solar Pool Heating System Details

(a) Collector Details:

Make: Fafco
Area: 256 ft²
Slope: 25°
Azimuth: Due South

(b) Pool Details:

Type: Outdoor Inground
Area: 550 ft²
Capacity: 14,000 Imperial Gallons
Backup Heater: Natural Gas
Pool Cover Used: Yes

2. Solar Performance

1981

Apr 14/81 - Sept 29/81

1,090 therms savings

Pool Water Temperature: 82°F

86% solar contribution

B. C. Hydro Representative

Pat Nash
Richmond, B. C.

BINNS RESIDENCE
BURNABY, B. C.

1. Solar Pool Heating System Details

(a) Collector Details:

Make: Homemade
Area: 700' of 1'2" ABC pipe (120 ft²)
Slope: 20°
Azimuth: 260° (80° west of due south)

(b) Pool Details:

Type: Outdoor Inground
Area: 648 ft²
Capacity: 16,200 Imperial Gallons
Backup Heater: Natural Gas
Pool Cover Used: No

2. Comments

- New solar pool account.
- Insufficient energy utilization data for 1981.

B. C. Hydro Representative

Don Hulme
Burnaby, B. C.

HURD RESIDENCE
COQUITLAM, B. C.

1. Solar Pool Heating System Details

(a) Collector Details:

Make: Fafco
Area: 384 ft²
Slope: 30°
Azimuth: Due South

(b) Pool Details:

Type: Outdoor Inground
Area: 512 ft²
Capacity: 12,800 Imperial Gallons
Backup Heater: Natural Gas
Pool Cover Used: No

2. Comments

- New solar pool account.
- Insufficient energy utilization data for 1981.

B. C. Hydro Representative

Peter Valkenburg
Coquitlam, B. C.

WEBB RESIDENCE
COQUITLAM, B. C.

1. Solar Pool Heating System Details

(a) Collector Details:

Make: Fafco
Area: 280 ft²
Slope: 30°
Azimuth: Due South

(b) Pool Details:

Type: Indoor Inground
Area: 630 ft²
Capacity: 16,000 Imperial Gallons
Backup Heater: Natural Gas
Pool Cover Used: Yes

2. Solar Performance

1981

Aug 4/81 - Nov 1/81

1180 therms savings

Pool Water Temperature: 83°F

92% solar contribution

B. C. Hydro Representative

Peter Valkenburg
Coquitlam, B. C.

CAYER RESIDENCE
SURREY, B. C.

1. Solar Pool Heating System Details

(a) Collector Details:

Make: Fafco
Area: 400 ft²
Slope: 35°
Azimuth: Due South

(b) Pool Details:

Type: Outdoor Inground
Area: 648 ft²
Capacity: 16,200 Imperial Gallons
Backup Heater: Natural Gas
Pool Cover Used: Yes

2. Solar Performance

1980

May 1/80 - Sept 3/80

950 therms savings

Pool Water Temperature: 81°F

76% solar contribution

3. Comments

- Mr. Cayer dropped out of our solar monitoring program as of October 1980.

B. C. Hydro Representative

Cliff Melin
Surrey, B. C.

GREAVES RESIDENCE
LANGLEY, B. C.

1. Solar Pool Heating System Details

(a) Collector Details:

Make: Fafco
Area: 320 ft²
Slope: 30°
Azimuth: Due South

(b) Pool Details:

Type: Outdoor Inground
Area: 512 ft²
Capacity: 12,800 Imperial Gallons
Backup Heater: Natural Gas
Pool Cover Used: Yes

2. Comments

- Mr. Greaves dropped out of our solar monitoring program as of April 1980.

B. C. Hydro Representative

Harold L'Heureux
Abbotsford, B. C.

PELTON RESIDENCE
MAPLE RIDGE, B. C.

1. Solar Pool Heating System Details

(a) Collector Details:

Make: Fafco
Area: 320 ft²
Slope: 27°
Azimuth: 160 ft² (due west) 160 ft² (due south)

(b) Pool Details:

Type: Outdoor Inground
Area: 684 ft²
Capacity: 17,100 Imperial Gallons
Backup Heater: Natural Gas
Pool Cover Used: Yes

2. Solar Performance

1980

Apr 15/80 - Sept 29/80	435 therms savings
Pool Water Temperature: 80°F	33% solar contribution

1981

Mar 12/81 - Sept 14/81	817 therms savings
Pool Water Temperature: 80°F	62% solar contribution

B. C. Hydro Representative

Dick Regeir
Maple Ridge, B. C.

LEHAY RESIDENCE
LANGLEY, B. C.

1. Solar Pool Heating System Details

(a) Collector Details:

Make: Homemade
Area: 144 ft² (300' of 1'2" ABC pipe)
Slope: 30°
Azimuth: Due South

(b) Pool Details:

Type: Outdoor Inground
Area: 800 ft²
Capacity: 20,000 Imperial Gallons
Backup Heater: Natural Gas
Pool Cover Used: Yes

2. Comment

- Insufficient energy utilization data for 1981.

B. C. Hydro Representative

Harold L'Heureux
Abbotsford, B. C.

WEAVER RESIDENCE
SURREY, B. C.

1. Solar Pool Heating System Details

(a) Collector Details:

Make: Fafco
Area: 256 ft²
Slope: 20°
Azimuth: Due South

(b) Pool Details:

Type: Outdoor Inground
Area: 684 ft²
Capacity: 17,100 Imperial Gallons
Backup Heater: Natural Gas
Pool Cover Used: Yes

2. Comments

- New solar pool heating account.
- No energy utilization data for 1981.

B. C. Hydro Representative

Cliff Melin
Surrey, B. C.

POOR

QUALITY

ORIGINAL

